

## Visual Acuity Change

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### Definition

This chapter discusses the symptoms, examination, and diagnostic thought processes involved in evaluating a patient experiencing an alteration in visual acuity. The following terms are frequently encountered in the setting of visual acuity loss and are therefore worthy of review.

*Central visual acuity:* This refers to the relatively small but vital part of the visual field used for reading; it is tested with conventional eye charts and corresponds to the function of the macular area of the retina.

*Marcus Gunn pupil:* Also called an afferent pupillary defect, a Marcus Gunn pupil is a pupil that shows a greater consensual response than direct response to light. It is detected with the swinging penlight test described in Chapter 110.

*Metamorphopsia:* A subjective alteration in shape or form.

*Photopsia:* The sensation of sparks or flashing lights. It is usually seen in the periphery of the visual field and most often is caused by mechanical traction on the retina.

*Scotoma:* A focal area of visual loss in one eye.

*Ocular media:* The normally transparent structures of the eye including the cornea, crystalline lens, and vitreous.

*Myopia.* Nearsightedness.

*Hyperopia.* Farsightedness.

*Presbyopia.* The loss of ability to focus for near vision that occurs universally with increasing age. It is usually first symptomatic in the fourth and fifth decades, and usually necessitates the use of glasses for close viewing.

### Technique

The rapidity of onset of symptoms and the nature of the visual symptoms are among the most important historic features to be discussed. Patients may include such disparate symptoms as loss of acuity, loss of visual field, and metamorphopsia under the rubric of "poor vision" if not pressed for details. Furthermore, associated symptoms such as pain, photophobia, headache, or photopsia can be of great value in investigating visual loss.

It is as fundamental to test the central visual acuity on any patient with a visual disturbance as it is to determine blood pressure on a patient in shock. In ambulatory patients, testing visual acuity at 20 feet (6 m) with an eye chart is optimal (Chapter 115). In other circumstances, measuring the visual acuity in each eye with a near visual acuity card is appropriate and sufficient.

Especially in the setting of visual symptoms, it is important to obtain the patient's best possible visual performance. Elderly and poorly attentive patients must be encouraged to proceed as far down the eye chart as possible. To exclude the possibility of a simple refractive error (e.g., nearsightedness) accounting for poor performance on visual acuity testing, vision must be rechecked with a pinhole in front of the tested eye to minimize the effect of refractive error.

If one suspects malingering as the cause of poor visual performance, the vision can be tested at two distances. If a patient claims to be able to read only the 20/400 letters at 20 feet (6 m), the same decreased level of visual acuity should allow reading of the 20/200 letters at 10 feet (3 m).

In the patient with a change in visual acuity, several aspects of the ophthalmic examination take on additional importance. The pupils must be examined with extraordinary care to detect the presence or absence of a Marcus Gunn pupil. Confrontation visual fields are performed for each eye. The ophthalmoscope is then used to assess the clarity of the ocular media; the absence of a red reflex suggests opacity of the ocular media. With a cataract, the observer's view of the fundus correlates well with the visual loss that can be attributed to the cataract. The fundus is then systematically examined with attention given to the optic disk, retinal vasculature, macula, and retinal pigmentation. Specific attention should be addressed to such signs as blurred disk margins, disk hyperemia, a large cup to disk ratio, retinal pigmentary changes, or an abnormal foveal light reflex.

### Basic Science

The mechanisms of visual loss are as diverse as the wide variety of clinical entities that cause it.

#### Refractive Error

The most common cause of subnormal visual acuity is an uncorrected refractive error. To eliminate this problem the patient is asked whether glasses have been previously worn, then is retested with a pinhole to minimize the effect of small refractive errors. It should be understood that presbyopia, the universal and gradual loss of accommodation that manifests itself in the fourth and fifth decades, is a very common cause of decreased visual acuity at close viewing distances and can be easily corrected with reading glasses.

Furthermore, refractive errors may be transient phenomena, as in diabetics whose blood glucose has recently been elevated. It is due to transient myopia caused by the reversible osmotic swelling of the crystalline lens that accompanies hyperglycemia. Return to baseline vision occurs after a few weeks of better glucose control.

### *Opacities of the Ocular Media*

The ocular media must be clear for good visual acuity. Corneal opacification, often a result of previous infection or trauma, is an unusual cause of decreased acuity and can be detected with a penlight. The most common opacity of the ocular media is cataract, opacity of the crystalline lens. Most cataracts are seen in the older population and have no known cause. Known causes of secondary cataracts include corticosteroids, radiation, metabolic disorders, ocular inflammation, and trauma.

Opacification of the vitreous gel is a further cause of medial opacity. It is usually the result of hemorrhage and is seen commonly in diabetics when abnormal retinal blood vessels (neovascularization) spontaneously bleed into the vitreous. Most vitreous hemorrhages clear spontaneously over weeks to months. However, surgical treatment is often needed to address the underlying cause of the neovascularization or to remove long-standing hemorrhage.

### *Retinal Disorders*

The most common cause of irreversible visual loss in the United States is age-related macular degeneration. In this frequently bilateral disorder, the macula undergoes localized atrophy, leading to decreased central visual acuity. Less frequently, scarring of the macula as the result of hemorrhage from a pathological neovascular membrane occurs. In either case, the macular region of the retina is irreversibly damaged, and central visual acuity is diminished.

Retinal detachment is an unusual cause of visual loss. The patients at high risk for this disorder include those with excessive myopia, peripheral retinal degeneration, and previous ocular trauma including intraocular surgery. In these disorders vitreous traction on the retina may result in retinal holes, thereby leading to retinal detachment. It is the traction on the retina that gives rise to photopsia, or flashes of light, as the neurosensory elements of the retina are mechanically stimulated.

### *Disorders of the Retinal Vasculature*

Diabetic retinopathy is the most common retinal vascular cause of visual acuity loss. Diabetes causes altered permeability of the retinal microvasculature, resulting in abnormally leaky vessels. Such vessels may predispose to retinal edema, which, if located in the macular region, causes decreased visual acuity. Visual acuity can also be lost to proliferative diabetic retinopathy, in which abnormal vasculature proliferation causes fibrovascular membranes that may bleed into the vitreous or exert traction on the retina, culminating in retinal detachment.

Nondiabetic retinovascular disorders can result in decreased visual acuity. Central retinal artery occlusion, which may be either embolic or thrombotic, nearly always leads to irreversible blindness in the affected eye. Temporary occlusion of the retinal arterial supply is the cause of amaurosis fugax, a symptom often described as a curtain coming down over one eye. Vision spontaneously is restored several minutes later. Cholesterol emboli from decreased carotid arteries are most often the cause; these emboli are ophthalmoscopically visible as crystalline plaques in retinal arterioles, confirming the diagnosis.

Loss of visual acuity can result from obstruction of the central retinal vein, causing diffuse retinal hemorrhages and edema, or from occlusion of a branch retinal vein with hemorrhage and edema localized to the macular region of the retina.

### *Optic Nerve Disorders*

*Glaucoma* refers to a group of disorders in which the intraocular pressure is sufficiently elevated to cause irreversible optic nerve damage. This progressive optic nerve atrophy initially causes only loss of visual field, which is usually asymptomatic. Loss of central visual acuity occurs late in the course of glaucoma, often without preceding symptoms. However, glaucoma may be detected in the presymptomatic stage by ophthalmoscopic evaluation of optic disk cupping. This cupping is caused by gradual atrophy of axons forming the optic disk rim, causing increasing pallor and atrophy of the neuroretinal tissue of the nerve.

Optic neuropathy may occur in a variety of clinical settings. In younger patients retrobulbar neuritis, manifested by acute visual loss in association with pain exacerbated by eye movements, is an inflammatory cause of optic nerve dysfunction. If recurrent or accompanied by other neurologic signs and symptoms, it suggests the diagnosis of multiple sclerosis. In the elderly, acute optic neuropathy is generally ischemic in origin. It classically presents with monocular loss of vision in association with an altitudinal (inferior or superior) visual field defect. Occasionally, acute ischemic anterior optic neuropathy is a manifestation of temporal arteritis.

### *Intracranial Disorders*

Intracranial causes of visual acuity changes are quite uncommon. Large pituitary tumors, aneurysms, and other parasellar masses can cause compressive neuropathy by involving the optic nerves, chiasm, and tracts, resulting in visual field loss and occasionally loss of central visual acuity. Lesions involving the temporal, parietal, and occipital cortices cause homonymous hemianopic visual field loss. Though sparing central vision, such lesions are visually disturbing to the patient. Their diagnosis is contingent upon the results of confrontation visual field testing.

### **Clinical Significance**

While it may ultimately require an ophthalmologist to make a definite diagnosis for a patient with a disturbance in visual acuity, the nonophthalmologist can often determine the correct diagnosis with proper diagnostic thinking and directed examination. Diagnosis in the setting of visual acuity change is important because of the many conditions that can be successfully treated after recognition and referral.

Relatively few acute processes cause severe bilateral simultaneous loss of visual acuity. Frequently, patients presenting with acute bilateral loss of acuity were not aware of prior visual loss in one eye and seek medical attention only when the second eye is affected. The truly acute conditions causing bilateral simultaneous loss of vision include nutritional deficiency (thiamine), methanol and quinine toxicity, and optic neuritis affecting the chiasm.

Sudden monocular loss of visual acuity in the younger patient suggests optic neuritis or retinal detachment. Optic neuritis, with variable severity of visual loss, is accompanied by retrobulbar pain exacerbated by eye movements and is associated with a Marcus Gunn pupil. Retinal detachment is typically preceded by floaters and photopsia and, if partial, may present as loss of visual field in one eye.

Loss or change of visual acuity in the diabetic patient has multiple causes. A most common visual disturbance in the diabetic is the blurred vision caused by periods of hyperglycemia. When the onset of diabetes mellitus can be determined, it is helpful to know that diabetic retinopathy does not usually occur until 10 to 15 years following the onset of the diabetes. The most common cause of decreased visual acuity in a diabetic is retinal edema, which can sometimes be improved with laser therapy. Neovascularization of the retina can result in vitreous hemorrhage, which may result in severe loss of visual acuity. Alternatively, neovascularization can lead to traction retinal detachment. Modern vitreoretinal microsurgery can often address chronic vitreous hemorrhage and traction retinal detachment in the diabetic.

Acute visual acuity change in the older patient is associated with other ocular conditions. Macular degeneration is the most common irreversible cause of blindness in the United States and can present with sudden monocular loss of vision caused by subretinal neovascularization and hemorrhage. Laser therapy may be helpful in the affected eye or the fellow eye, which will undergo similar changes in many patients.

Retinovascular disease can also cause sudden loss of vision in the elderly. Central retinal artery occlusion is a true ophthalmic emergency necessitating ophthalmic care within 2 hours if any vision is to be restored. Central retinal artery occlusion most often presents with profound and instantaneous loss of vision associated with a Marcus Gunn pupil

and a cherry red spot in the fundus. Venous retinal occlusion, complete or incomplete, is associated with visual loss and diffuse retinal edema and hemorrhages.

Acute ischemic anterior optic neuropathy is another cause of sudden monocular visual loss in the older population. The occlusion may be arteric or thrombotic, and such patients therefore require a work-up for temporal arteritis. Clinically, there is loss of the superior or inferior visual field, a Marcus Gunn pupil, and optic disk swelling.

Painless, gradual, and nonsimultaneous loss of visual acuity is also seen in the elderly. Such patients usually have cataract, glaucoma, or macular degeneration. Cataract is associated with obscuration of the fundus view in proportion to the patient's visual acuity; glaucoma with subjective visual loss is associated with advanced cupping of the optic disk. Macular degeneration is diagnosed by ophthalmoscopic abnormality in the macula including increased pigmentation or decreased pigmentation with atrophy.

## References

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